

(19) World Intellectual Property Organization  
International Bureau



(43) International Publication Date  
24 July 2003 (24.07.2003)

PCT

(10) International Publication Number  
**WO 03/059768 A1**

(51) International Patent Classification<sup>7</sup>: **B65D 41/04**

SD, SG, SL, TJ, TM, TN, TT, TZ, UA, UG, US, UZ, VC,  
VN, YU, ZA, ZM, ZW.

(21) International Application Number: PCT/GR03/00001

(22) International Filing Date: 15 January 2003 (15.01.2003)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:  
20020100015 16 January 2002 (16.01.2002) GR  
20020100016 16 January 2002 (16.01.2002) GR

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(81) Designated States (national): AE, AG, AL, AM, AU, AZ,  
BA, BB, BG, BR, BY, BZ, CA, CH, CN, CO, CR, CU, CZ,  
DM, DZ, EC, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP,  
KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LV, MA, MD,  
MG, MK, MN, MW, MX, MZ, NZ, OM, PH, RO, RU, SC,

(84) Designated States (regional): ARIPO patent (GH, GM,  
KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZM, ZW),  
Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM),  
European patent (AT, BE, BG, CH, CY, CZ, DE, DK, EE,  
ES, FI, FR, GB, GR, HU, IE, IT, LU, MC, NL, PT, SE, SI,  
SK, TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN,  
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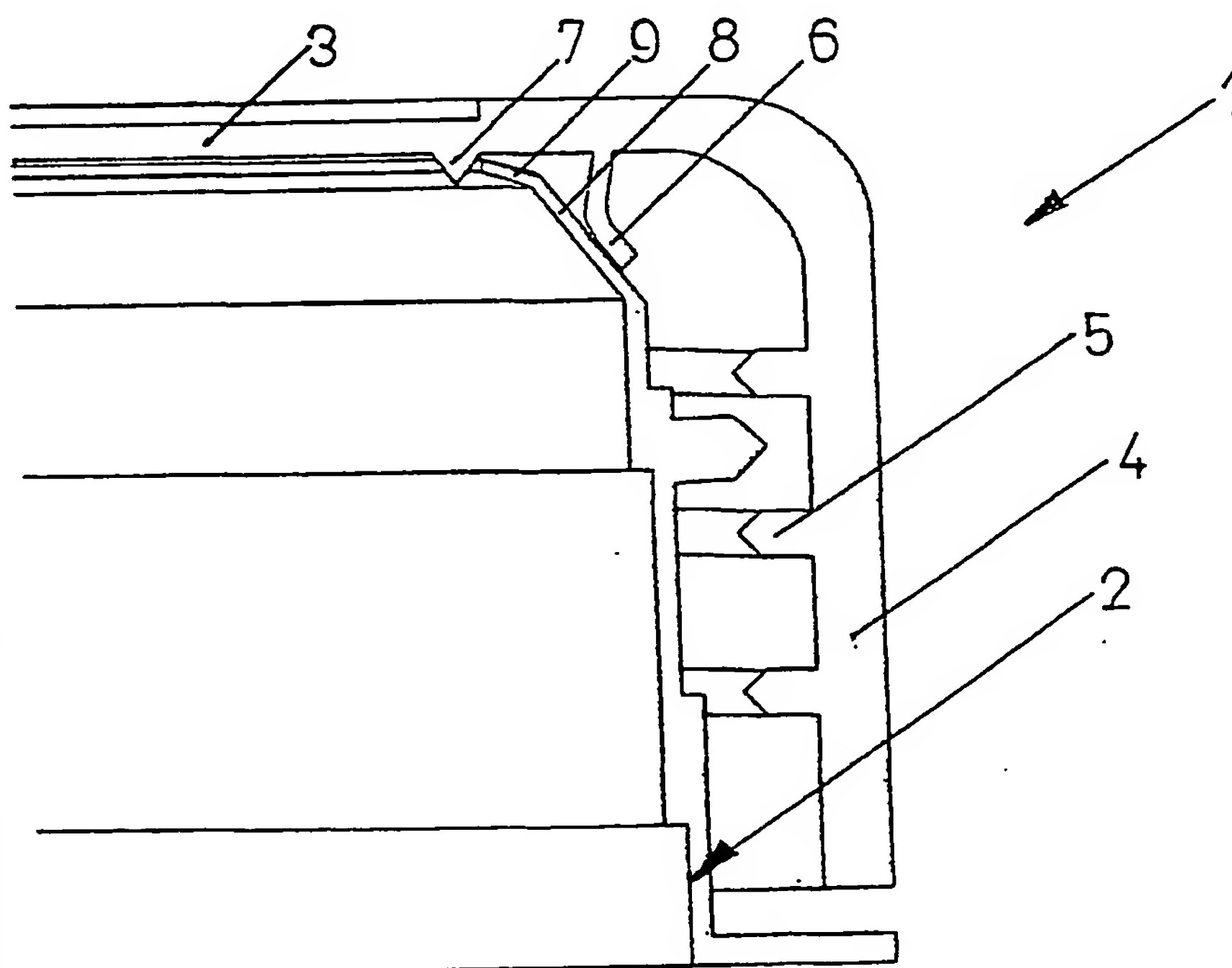
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- of inventorship (Rule 4.17(iv)) for US only

**Published:**

- with international search report
- before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

(54) Title: PLASTIC CLOSING CAP WITH SEALING RING



(57) Abstract: A closing cap moulded in one piece from a plastics material for sealing a container with a threaded neck has a top plate (3), an annular skirt (4) with an internal screw thread (5) adapted to cooperate with the threaded container neck (2), and an integrally moulded deformable annular sealing ring (6) extending downwardly from an inner surface of said top plate (3) and spaced radially inwardly of the annular skirt (4), wherein when the closing cap (1) is screwed onto the container neck (2), the sealing ring (6) is deformed outwardly and is fully conformed to the outer surface of the container neck (2) without being clamped between the container neck (2) and the annular skirt (4) and without being pressed against the annular skirt (4).

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## PLASTIC CLOSING CAP WITH SEALING RING

## TECHNICAL FIELD OF THE INVENTION

10 The present invention relates to a plastic closing cap for a container with an annular sealing ring.

## BACKGROUND OF THE INVENTION

15 Container closures moulded in one piece from a plastic material including downwardly depending seals are well known in the art. The purpose of these arrangements is to enable a cap to be easily screwed onto a container neck such that the edge of the container neck seals against the underside of the top plate of the cap, while the sealing ring is pressed  
20 into firm sealing engagement with the edge of the container neck.

In the case of containers made of plastics material it can certainly happen that the edge of the container neck has  
25 suffered minor damage, deformation and/or irregularities caused during the manufacturing procedure, and which are sufficient to have a negative effect on the sealing engagement between the edge of the container neck and sealing elements of the cap.

30 Thus, a deteriorated seal in the case of bottles for carbonated drinks can have the result that gas escapes from the bottle and after a few days of storage the drink has lost its carbon dioxide and is tasteless.

35 The known closures therefore still do not guarantee absolutely sealing integrity in the event of minor damage or deformation of the edge of the container neck.

40 In addition, caps when applied to plastic containers for sterilized beverage e.g. milk or dairy products, must also meet rigid requirements to prevent contamination and the overall cap structure must be leak-proof. In order to provide a liquid-tight seal it is, therefore, known to use  
45 either a sealing laminated membrane on the opening of the container or a separate liner inside of the cap.

However, these arrangements are characterized by higher manufacturing and/or recycling costs while cannot guarantee  
50 reliable sealing integrity.

## SUMMARY OF THE INVENTION

5 It is, therefore, an object of the present invention to provide an improved plastic closing cap, which overcomes the deficiencies of the prior art and ensures reliably the sealing function and prevents leaks in the event of minor  
10 damage or deformation of the container neck.

A further aspect of the present invention is to provide a closing cap particular useful for sterilized products such as milk or dairy products which provides easy opening and  
15 reclosing of the container and effectively sealing prior to and after reclosing.

In accordance with the above objects of the present invention, a closing cap moulded in one piece from a  
20 plastics material for sealing a container with a threaded neck is provided comprising a top plate which is substantially in the form of a circular disc, a substantially cylindrical peripheral portion extending downwardly from said top plate, said peripheral portion having an internal  
25 screw thread adapted to cooperate with the threaded container neck, an integrally moulded deformable sealing ring extending downwardly from an inner surface of said top plate and spaced radially inward of the substantially cylindrical peripheral portion, wherein when said closing  
30 cap is applied onto the threaded container neck, said sealing ring is adapted to radially deform outwardly and seal at least substantially along the outer surface of the container neck by virtue of the elastic return forces without being clamped between the container neck and the  
35 substantially cylindrical peripheral portion and without being pressed against the substantially cylindrical peripheral portion.

40 Further preferred embodiments of the present invention are defined in dependent claims 2 to 17.

The closing cap of the invention is ergonomic by offering compactness, and it adapts very easily to any container necks.  
45 In the closed position it ensures perfect sealing. The cap is also able to retain a liquid-tight seal after a period of time due to its configuration in conjunction with its material's characteristics. Operations of assembling the cap together on the neck of the  
50 container is quick and very easy.

Other objects and advantages of the present invention will become apparent to those skilled in the art in view of the following detailed description taken in conjunction with the accompanying drawings, wherein like reference numbers refer to similar parts throughout the drawings, and wherein:

#### 10 BRIEF DESCRIPTION OF THE DRAWINGS

15 Figs. 1A and 1B show a perspective view, partially broken away, of a closing cap according to the present invention applied to the container prior to, and after formation of a seal;

20 Figs. 2A and 2B show a perspective view, partially broken away, of a second alternative closing cap according to the present invention applied to the container prior to, and after formation of a seal;

25 Figs. 3A and 3B show a perspective view, partially broken away, of a third alternative closing cap according to the present invention applied to the container prior to, and after formation of a seal;

30 Figs. 4A and 4B show a perspective view, partially broken away, of another alternative closing cap according to the present invention applied to the container prior to, and after formation of a seal;

35 Figs. 5A and 5B show a partial cross-sectional view of an alternative closing cap according to the present invention in place on a container prior to, and after removal of the laminated disc; and

40 Fig. 6A and 6B show a partial cross-sectional view of a further alternative closing cap according to the present invention in place on a container prior to, and after removal of the laminated disc.

#### DETAILED DESCRIPTION OF THE INVENTION

45 Referring first to Figure 5A of the drawings, the closing cap 1 is moulded in one piece from a resilient plastics material and has a top plate 3 in the shape of a circular disc and an annular skirt 4 peripherally downwardly depending therefrom. The annular skirt 4 has an internal screw thread 5. On the inner surface of the top plate 3  
50 extending downwardly there is an integrally moulded thin,



5 deformable annular sealing ring 6 of uniform thickness which  
is of substantially cylindrical construction. In addition,  
the sealing ring 6 is disposed at a position spaced radially  
inwardly of the annular skirt 4, and concentric with said  
annular skirt. Said sealing ring 6 has a length such as to  
10 permit its portion adjoining its free edge to extend along  
the upper outer surface of the container neck 2. The sealing  
ring 6 is made of the same plastic material as the cap 1 and  
preferably has a thickness of equal or less than 0.8mm.

15 A container has an annular neck 2 with an external thread  
formed thereon.

In accordance with one aspect of the present invention the  
closing cap is adapted for use with a container, which is a  
thin-walled light weight blow-molded plastic bottle (e.g.  
for milk or dairy products) provided with an externally  
20 screw-threaded neck 2. The container neck 2 has above its  
threads an upwardly and inwardly directed portion 8 which is  
tapered (e.g. frusto-conically) and may have a substantially  
radially inwardly directed rim 9 for engagement with a stop  
means 7 of the closing cap referred to below.

25 In use, as depicted in Figs. 1A and 1B, the closing cap 1 is  
applied to the container neck 2 so that the top of the  
container neck moves upwardly as in Figure 1A to adopt the  
position shown in Figure 1B.

30 As it does so the sealing ring 6 first comes into contact  
with the outer surface of the container neck 2 while the  
closing cap 1 is being rotated during the capping operation.  
Further rotation of the closing cap 1 relative to the  
container neck 2 causes the container neck 2 to move  
35 upwardly relative to the closing cap 2 to adopt the position  
shown in Figure 1B.

On the inner surface of the top plate, the sealing ring 6 is  
disposed at a radius approximately equal to the radial  
distance of the middle of the tapered portion 8 of the  
40 container neck 2. Therefore, during the capping operation  
the sealing ring 6 is being urged away by the tapered  
portion 8 of the container neck 2 and thus it is deformed  
radially outwardly, and lies against the outer surface of  
the tapered portion 8 of the container neck, and has a  
45 sufficient length in contact with it.

Hence, the sealing ring 6 is fully conformed to the outer  
surface of the container neck 2 by virtue of its elasticity  
without being clamped between the container neck 2 and the  
annular skirt 4 and without being pressed against the skirt  
50 4.

5 In this condition an effective tight seal is formed between the outer surface of the tapered portion 8 of the container neck 2 and the inner surface of the sealing ring 6. Moreover, due to the elastic return forces which occur in that case and the deformation of the sealing ring 6 in conjunction with the resilience of the plastics material, 10 said seal is maintained despite relaxation.

At the same time, because of this radial displacement of the sealing ring 6, there is a pivotal force applied to the 15 inner surface of the top plate 3 which tends to resist doming in conjunction with the stop means 7 of the cap referred to below.

20 Referring now to Figures 2A and 2B of the drawings, another modification of the present invention is shown in which the sealing ring is L-shaped and sealing integrity is afforded by virtue of engagement of the short side of the L-shaped sealing ring, which is parallel to the top plate of the cap, with the upper portion (tapered portion) of the container 25 neck, wherein said short side is displaced inwardly and is then clamped between the outside surface of the container neck and the long side of the L-shaped sealing ring.

30 Figs. 3A and 3B show another modification of the invention in which the sealing ring is attached to the annular skirt above its internal threads and is substantially parallel to the top plate of the cap.

35 Figures 4A and 4B show a further modification of the present invention in which the sealing ring is attached to the inner surface of the top plate of the cap at a position spaced radially inwardly of the annular skirt and extends downwardly and inwardly (conical) from the top plate of the 40 cap.

Arrangements of the foregoing type are used with a further main feature of the invention shown in Figures 1 to 6, i.e. the stop means 7.

45 Figs. 5A and 5B show an alternative modification for use in cases where there is a laminated disc 10 sealed on the container opening.

The laminated disc is attached to and sealed on the 50 containers by means of a plastic heat shrinkable tube which insures a tight sealing engagement about the container opening. This arrangement offers many advantages, e.g. high

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shapping nature and high-temp resistance, tight sealing and  
5 better fineness.

The stop means 7 is a shallow ring which extends downwardly  
from the inner surface of the top plate 3. It is disposed  
radially inwardly of the sealing ring 6, and has an external  
10 diameter which is slightly smaller than the inner diameter  
of the inwardly directed rim 9 of the container neck 2,  
namely slightly smaller than the container opening.  
The stop means is further provided with a tapering conical  
tip.

15 As shown in Fig.5A, during the capping procedure, the  
laminated disc 10 at the region of the rim portion 9 of the  
container neck 2 comes into contact with the tapering tip of  
the stop means 7 which has the effect of limiting the  
20 upwardly movement of the container neck 2. In this condition  
the closing cap 1 is screwed onto the container neck 2, the  
sealing ring 6 is not deformed and a liduid-tight seal is  
provided by the laminated disc 10.

25 Once the container has been opened and the laminated disc 10  
has been removed, the reclosing of the container is achieved  
in that the closing cap 1 is further rotated, and due to the  
relative movement between the container neck 2 and the cap  
1, the stop means 7 adopts the position shown in Figure 5B.  
30 Only just during this reclosing procedure the sealing ring 6  
comes into contact with the tapered portion 8 of the  
container neck 2 and is thereby deformed.

35 Because the stop means 7 is intended essentially and  
primarily as a restriction and secondly as a seal, the main  
sealing effect also in this modification is to be found  
between the outer surface of the tapered portion 8 of the  
container neck 2 and the inner surface of the sealing ring  
6.

40 Further, because the stop means 7 is disposed in-board of  
the sealing ring 6, it tends to strengthen the central  
portion of the top plate 3. This resists doming.

45 It will thus be seen that during reclosing of the cap 1 to  
the container neck 2, the outer surface of the tapered  
portion 8 of the container neck 2 first comes into contact  
with the sealing ring 6 thereby causing effective sealing.

50 It will also be appreciated that by virtue of the relative  
thickness of the flexible sealing ring 6 taken with the

effects of the stop means 7, a more effective seal is provided than previously.

5

The stop means 7 and the stiffness of the top plate 3 together result in that the effects of doming upon the sealing ring 6 are reduced thus ensuring that the sealing ring 6 does not get pulled out of sealing engagement with the container neck 2.

10

Further, the stop means 7 acts as a stiffening rib and may be continuous or discontinuous.

15

The arrangement shown in Figures 6A and 6B is similar to that in Figures 5A and 5B, but in Figs. 6A and 6B the stop means 7 is an annular disc depending from the inner surface of the top plate 3 of the cap and is generally trapezoidal in cross section, decreasing in a direction downwardly and away from the the top plate.

20

The inventive closing caps are preferably made by injection moulding of polypropylene or high density polyethylene plastics materials.

25

The stop means is intended to have sealing properties but needs to be used in conjunction with a primary seal for example as hereinbefore set forth.

30

The closing cap is designed to be fitted onto a glass or plastic container, such as a soft drink bottle. It should be noted that the container can hold various liquids including, but not limited to, dairy products, a carbonated beverage, a non-carbonated liquid or a vaporized product.

35

Closures of this type may be produced, preferably by injection moulding, with or without tamper evident band. Preferably the skirt terminates in a plurality of frangible bridges supporting a tamper evident band for cooperation with a plain security band on the outer neck portion of the container neck in the usual way.

40

The skirt is preferably provided with external knurling or vertical ribbing to improve manual grip.

45

The thickness of the sealing ring may be preferably more than 0.80mm.

50

While preferred embodiments have been shown and described obviously minor modifications in design and construction can be effected in the invention without departing from the spirit and scope thereof, as defined in the appended claims.



## CLAIMS

- 5 1. A closing cap moulded in one piece from a plastics material for sealing a container with a threaded neck comprising:  
a top plate (3) which is substantially in the form of a circular disc;  
10 a substantially cylindrical peripheral portion (4) extending downwardly from said top plate (3), said peripheral portion having an internal screw thread (5) adapted to cooperate with the threaded container neck (2);  
an integrally moulded deformable annular sealing ring (6)  
15 extending downwardly from an inner surface of said top plate (3) and spaced radially inward of the substantially cylindrical peripheral portion (4), wherein when said closing cap (1) is applied onto the threaded container neck (2), said sealing ring (6) is adapted to radially deform  
20 outwardly and seal at least substantially along the outer surface of the container neck (2) by virtue of the elastic return forces without being clamped between the container neck (2) and the substantially cylindrical peripheral portion (4) and without being pressed against said  
25 substantially cylindrical peripheral portion (4).
2. The closing cap according to claim 1, wherein said sealing means (6) is substantially cylindrical.
- 30 3. The closing cap according to claim 1, wherein said sealing means (6) is L-shaped.
4. The closing cap according to any preceding claim, wherein said sealing means (6) has a uniform thickness of equal or  
35 less than 0.80mm.
5. The closing cap according to any preceding claim, wherein said outer surface of the container neck (2) has, above its threads, an upwardly and inwardly directed tapered portion  
40 (8) and a substantially radially inwardly directed rim (9) and said sealing ring (6) is disposed at a radius approximately equal to the radial distance of the middle of the tapered portion (8) of the container neck (2).
- 45 6. The closing cap according to claim 6, wherein said sealing ring (6) is deformed radially outwardly by the tapered portion (8) of the container neck (2) and is fully conformed to the outer surface of the container neck (2) by virtue of its elasticity without being pressed against the  
50 substantially cylindrical peripheral portion (4).

7. The closing cap according to any preceding claim further comprising a continuous or discontinuous stop means (7) extending downwardly from the inner surface of said top plate (3) and disposed radially inwardly of said deformable sealing ring (6).
8. The closing cap according to claim 8, wherein said stop means (7) has an external diameter which is slightly smaller than an inner diameter of the substantially radially inwardly directed rim (9) of the container neck (2).
9. The closing cap according to any preceding claim, wherein said stop means (7) is adapted to limit the upwardly movement of the container neck (2).
10. The closing cap according to any preceding claim, wherein said stop means (7) is adapted to be inserted in the opening of the container neck (2) after removal of the sealing laminated disc (10).
11. The closing cap according to any preceding claim, wherein said sealing ring (6) only just during the reclosing procedure and after removal of the laminated disc (10) first comes into contact with the tapered portion (8) of the container neck (2) and is thereby deformed.
12. The closing cap according to any preceding claim, wherein said stop means (7) is a shallow ring with a tapering conical tip.
13. The closing cap according to any preceding claim, wherein said stop means (7) is an annular disc.
14. The closing cap according to any preceding claim, wherein said substantially cylindrical peripheral portion (4) has at its distal end a tamper evident band for cooperation with a security band on the outer neck portion of the container neck (2).
15. The closing cap according to any preceding claim, wherein said substantially cylindrical peripheral portion (4) is provided with external knurling.
16. The closing cap according to any preceding claim, wherein said closing cap (1) is made by injection moulding.
17. An assembly of a container having a threaded neck and a closing cap (1) according to any one of the preceding claims.

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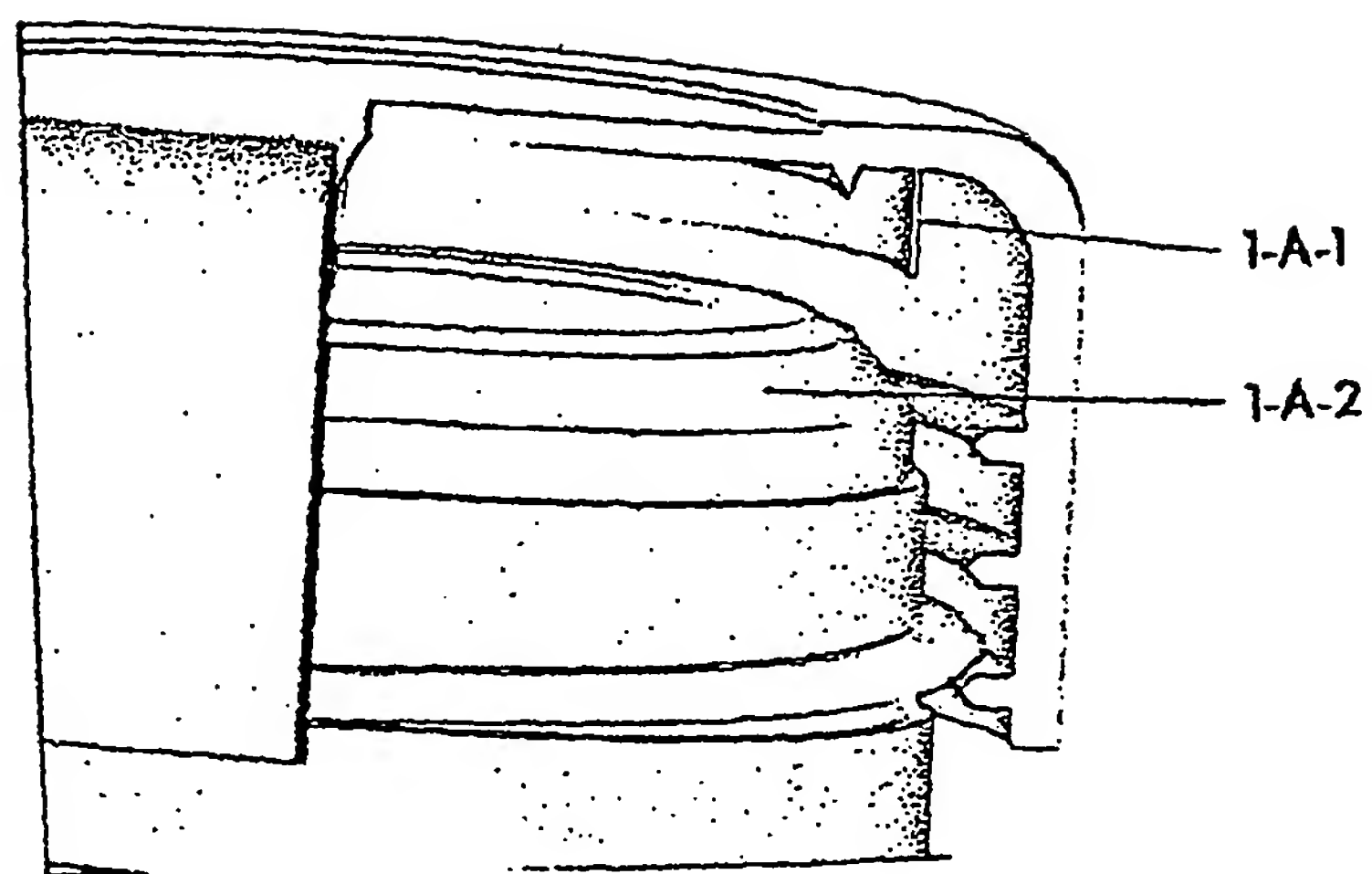


FIG. 1A

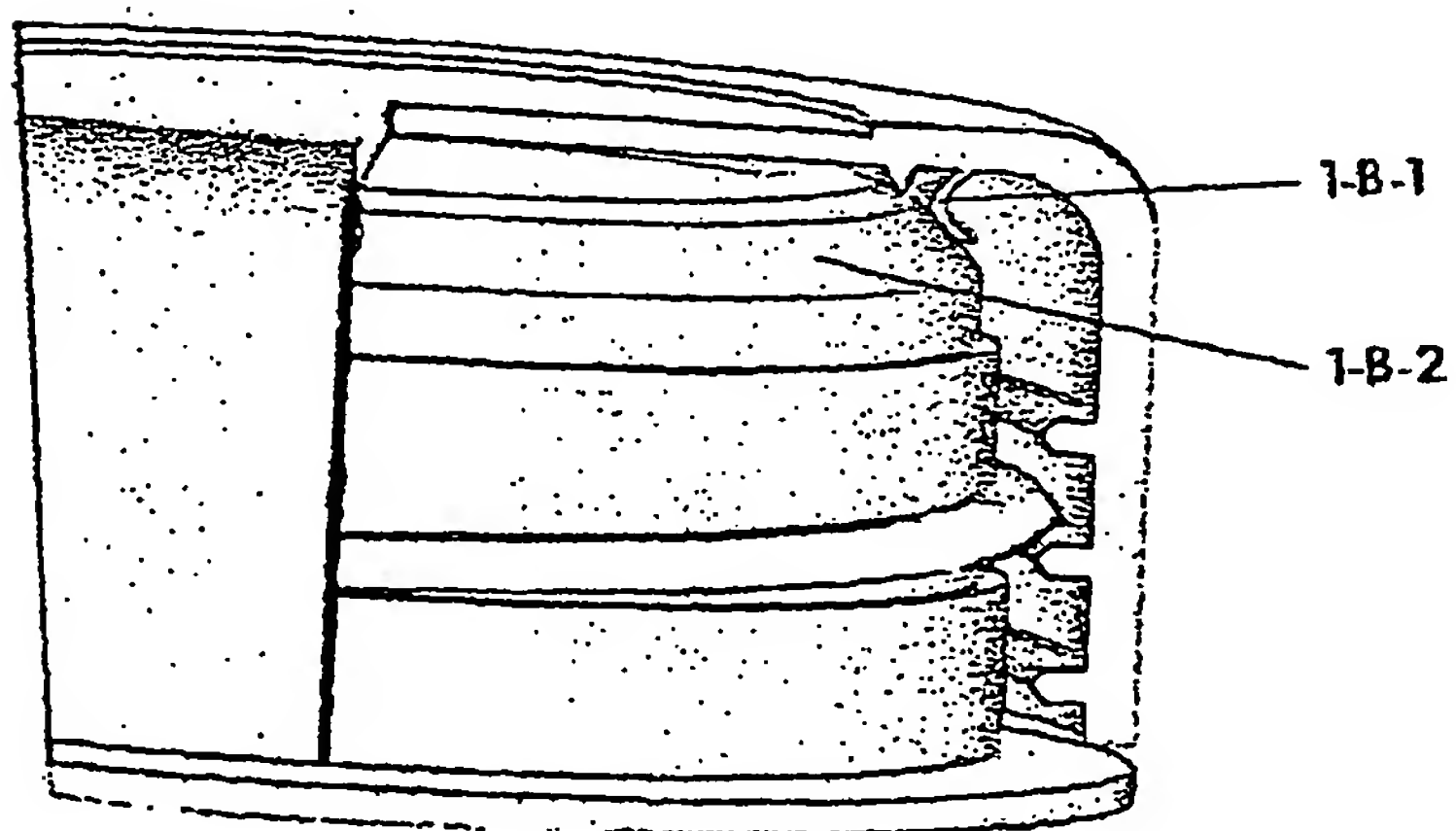


FIG. 1B

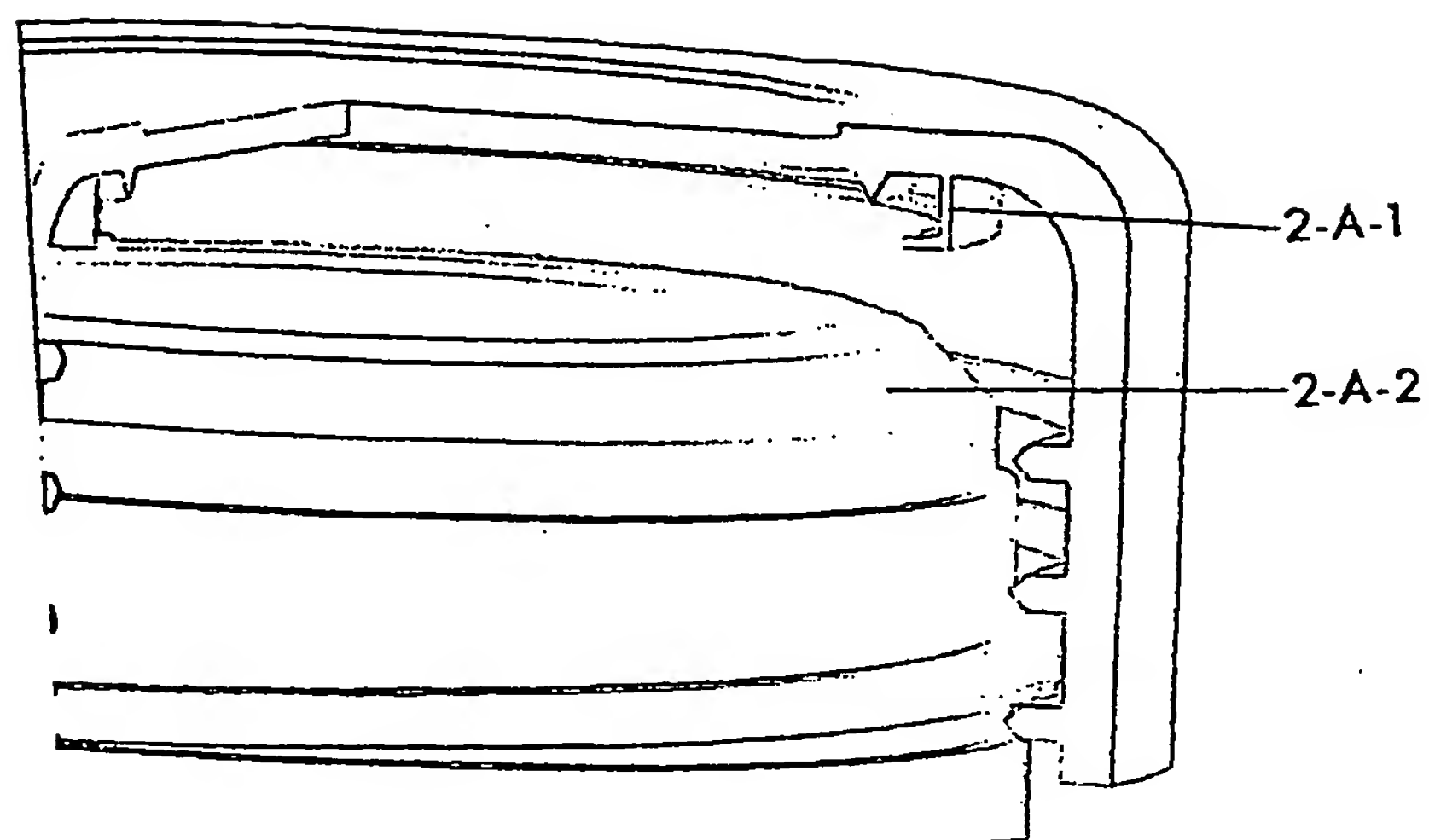


FIG. 2A

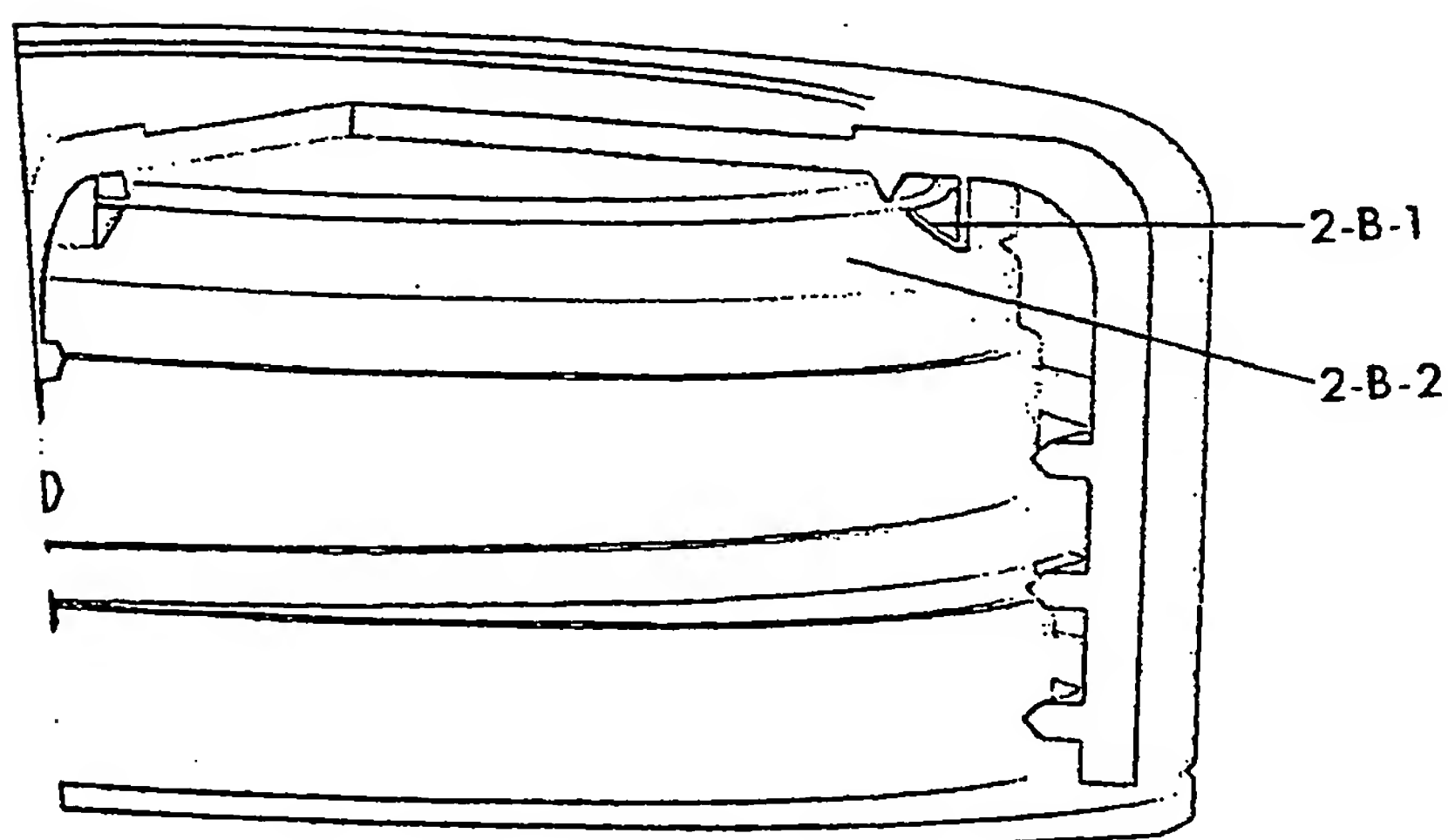


FIG. 2B



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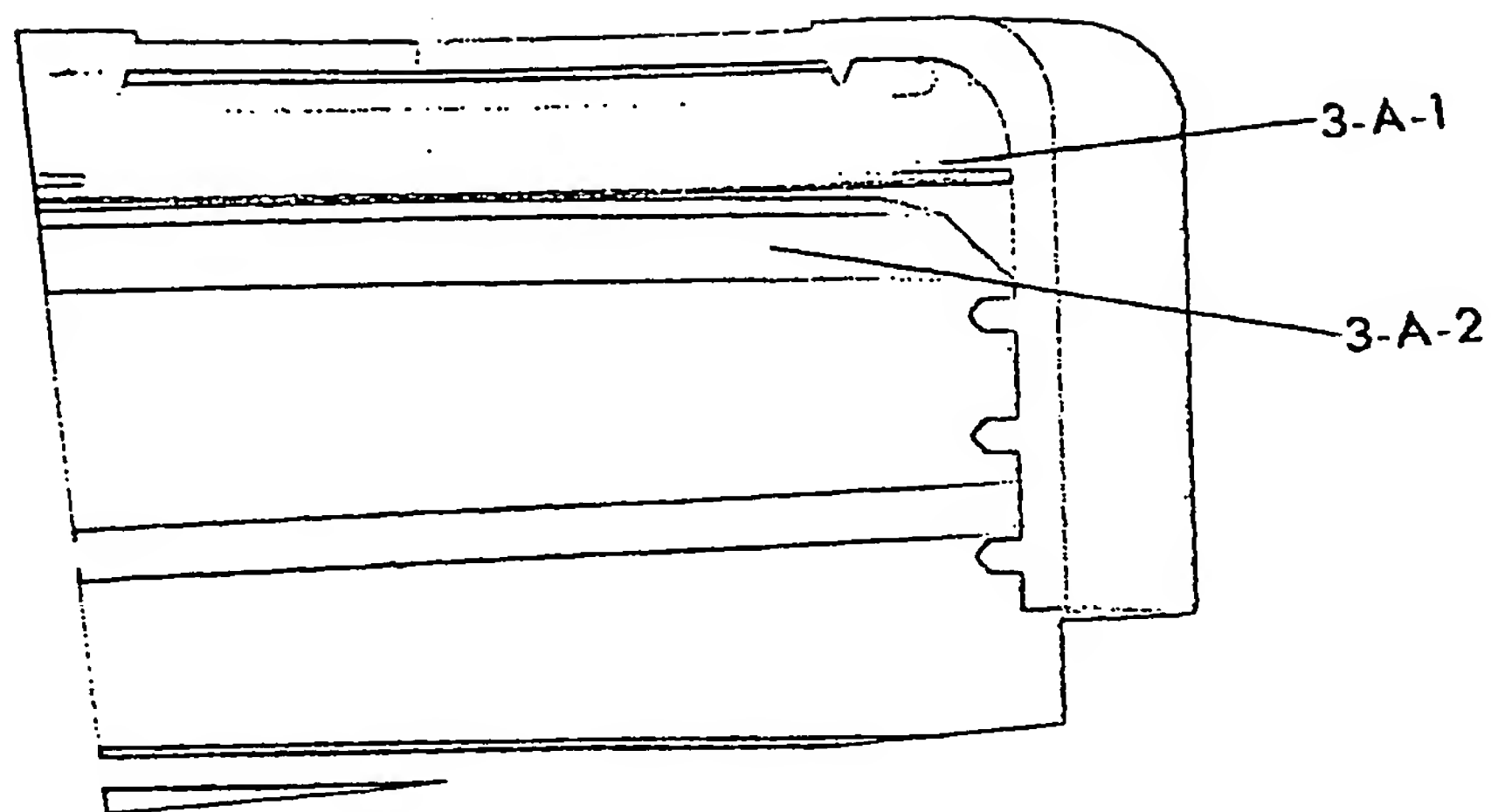


FIG. 3A

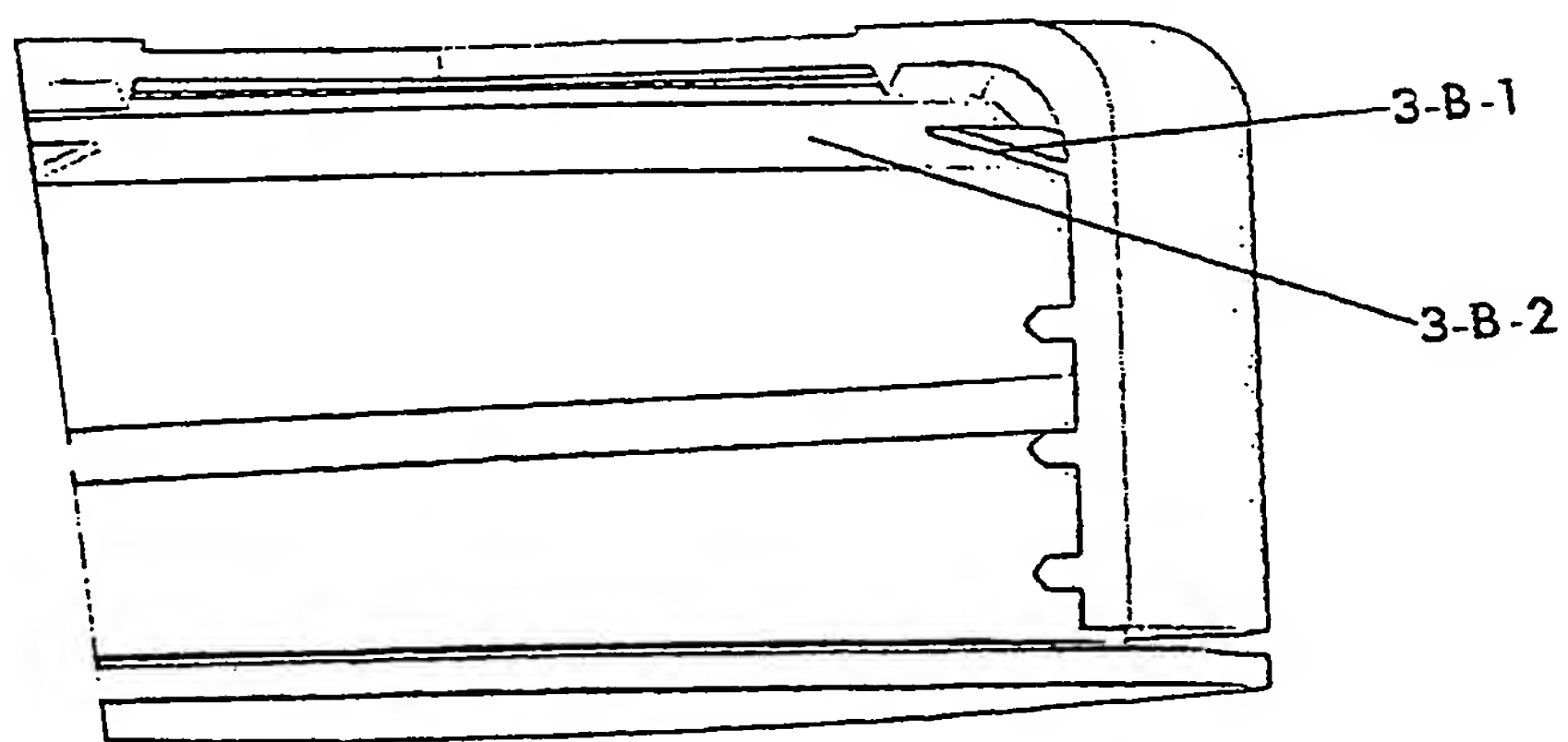


FIG. 3B

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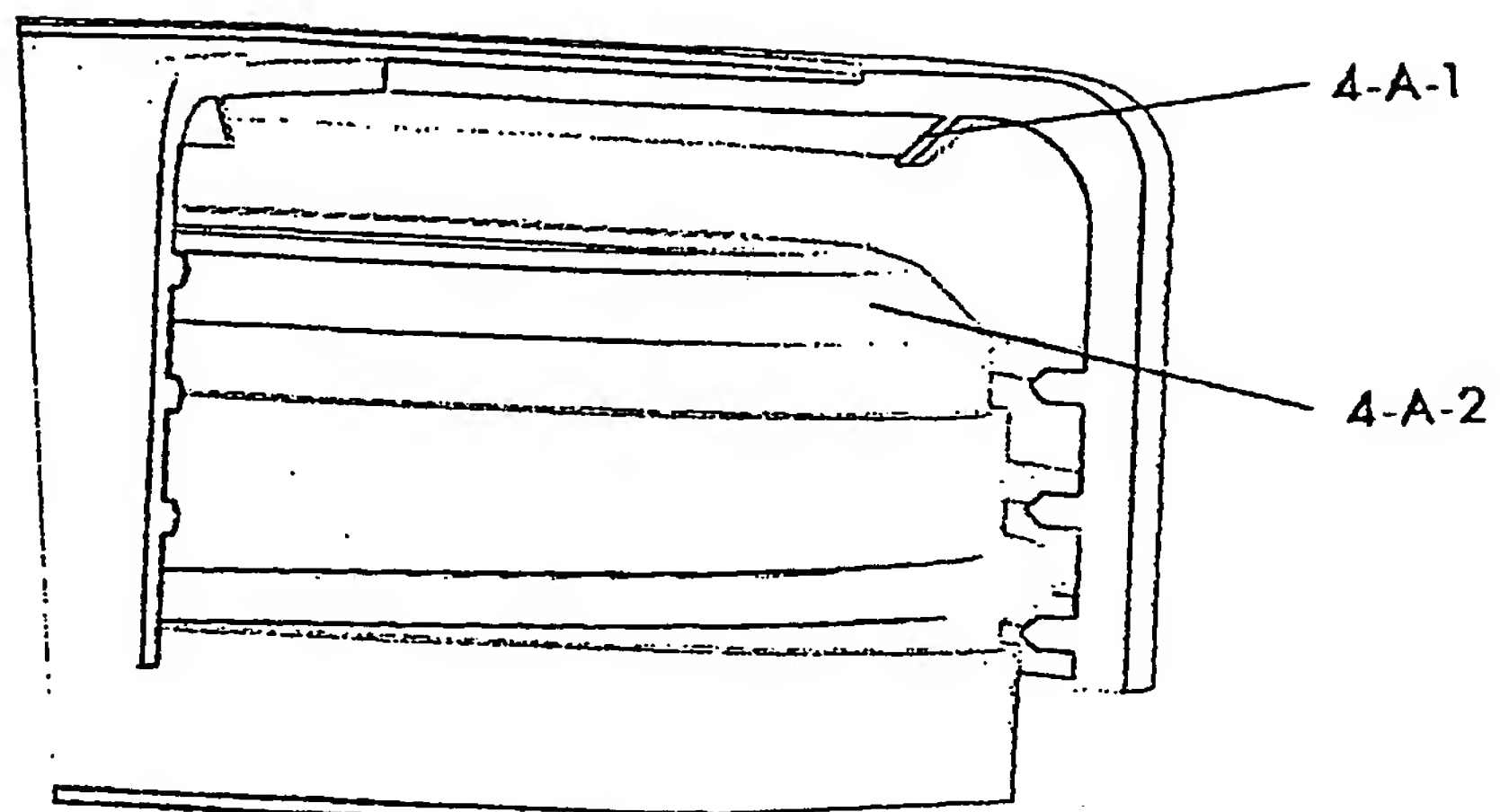


FIG. 4A

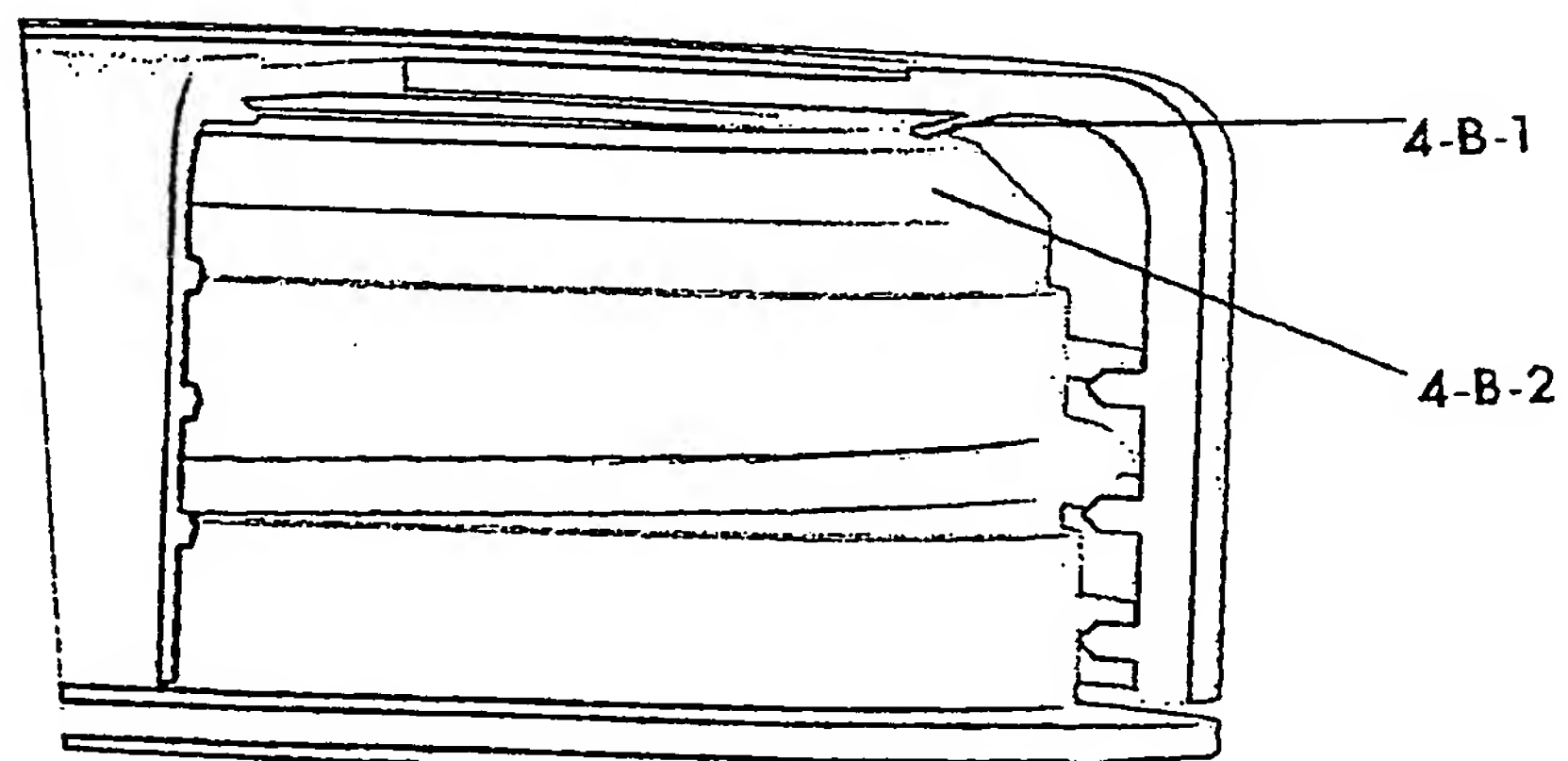


FIG. 4B

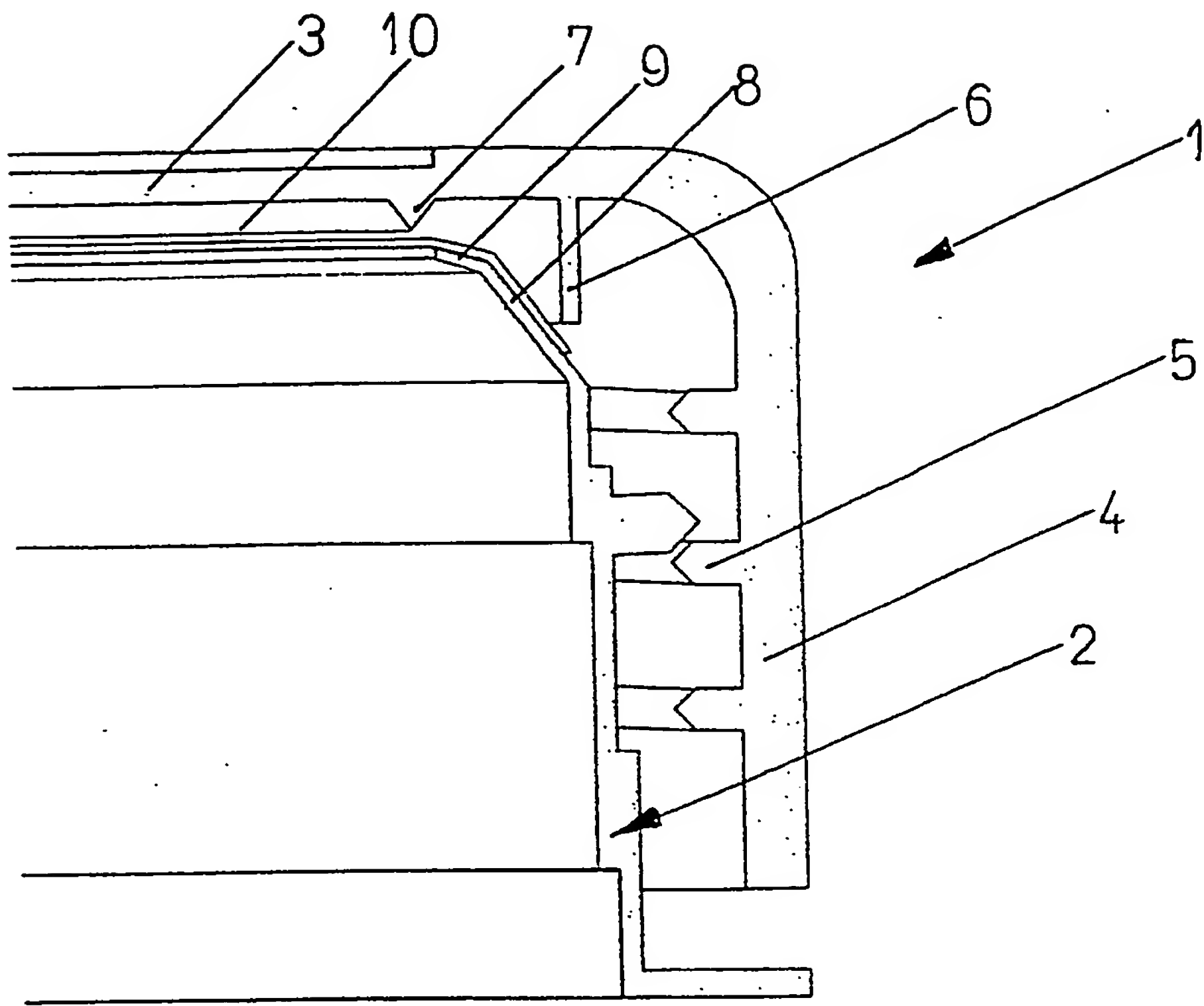


FIG. 5A

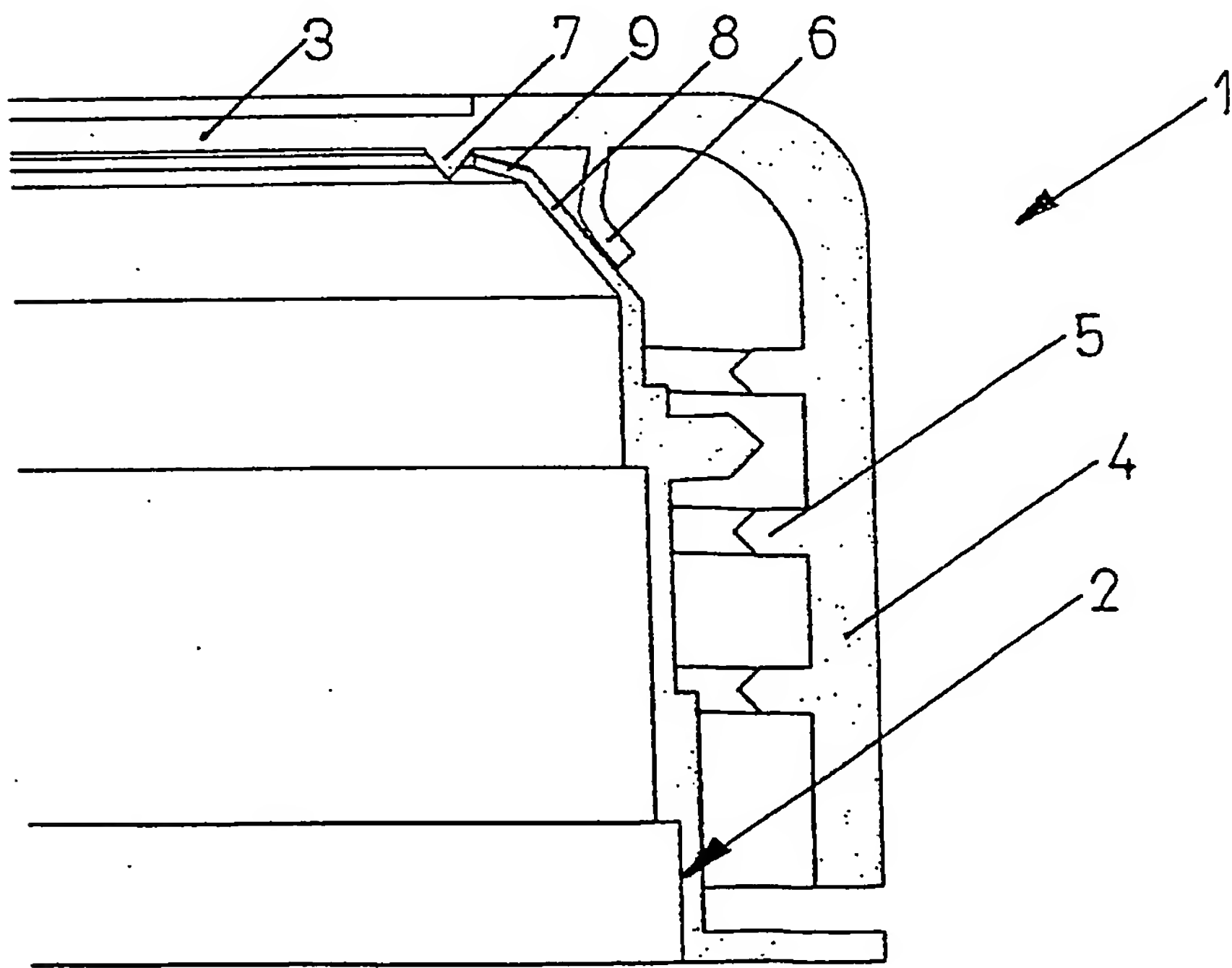


FIG. 5B

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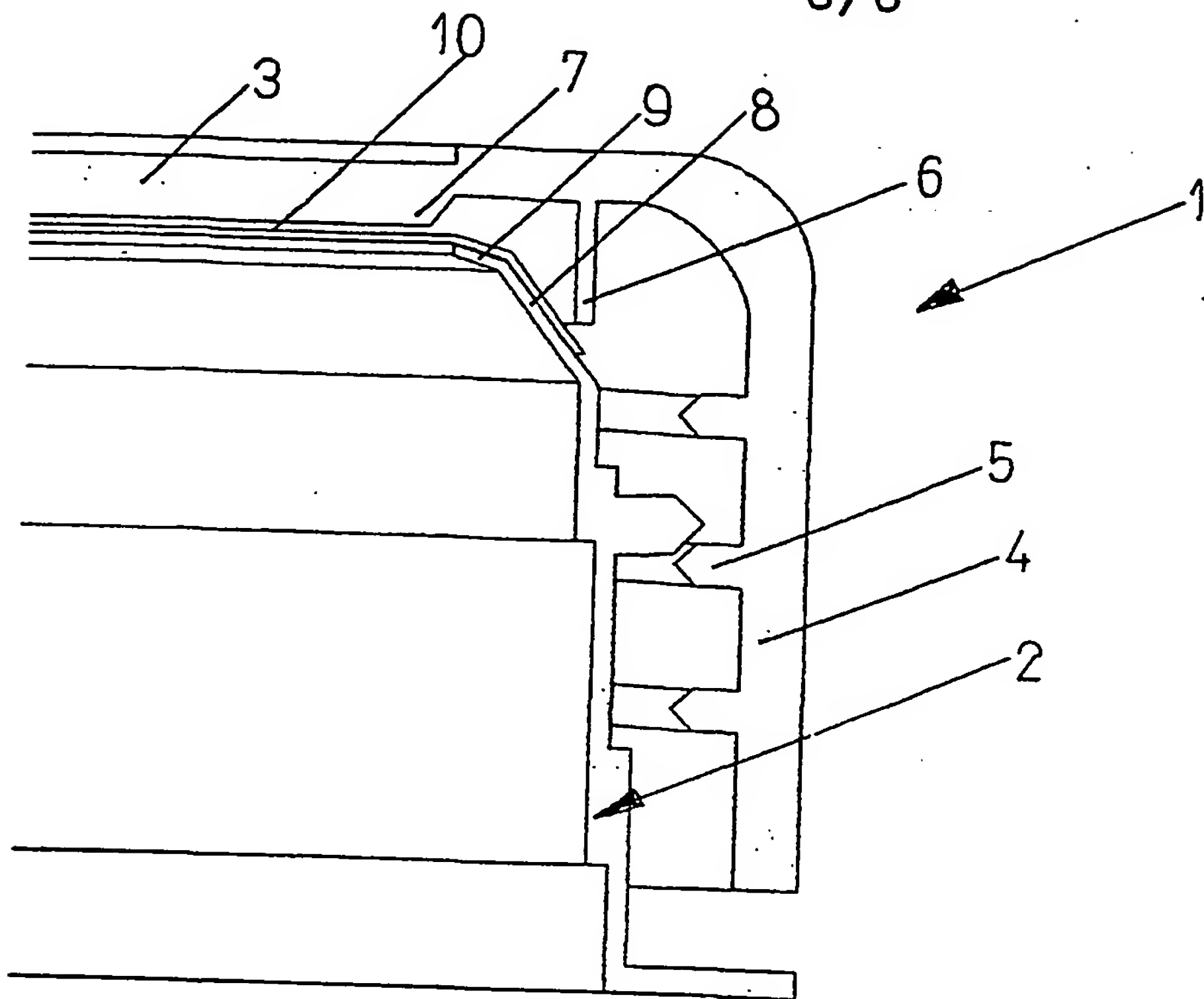


FIG. 6A

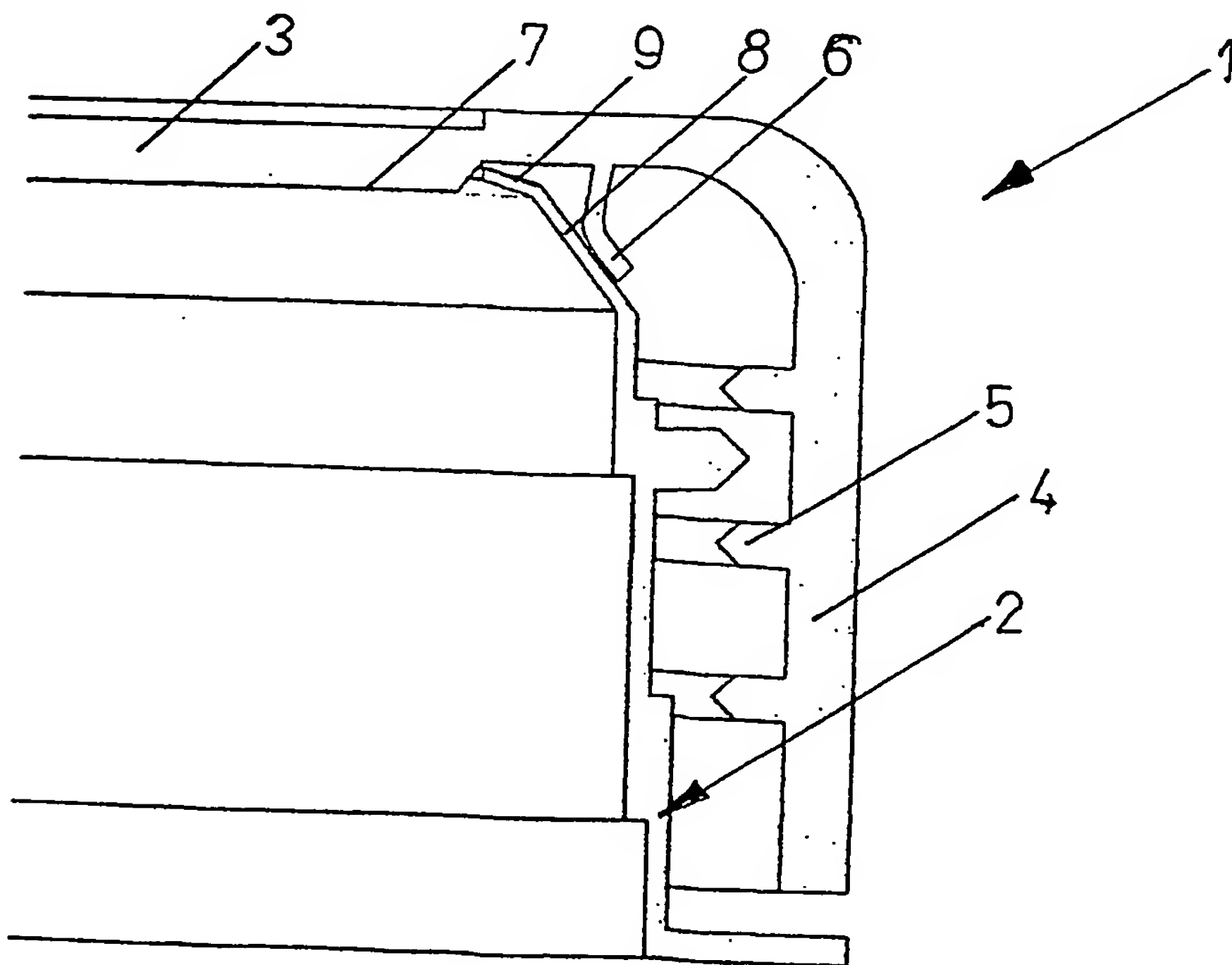


FIG. 6B



C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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**A. CLASSIFICATION OF SUBJECT MATTER**  
 IPC 7 B65D41/04

According to International Patent Classification (IPC) or to both national classification and IPC

**B. FIELDS SEARCHED**

 Minimum documentation searched (classification system followed by classification symbols)  
 IPC 7 B65D

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 Electronic data base consulted during the international search (name of data base and, where practical, search terms used)  
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**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

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☒ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

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Date of the actual completion of the international search

5 May 2003

Date of mailing of the international search report

13/05/2003

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